



***Integrity ★ Service ★ Excellence***

## **SOARD Overview**

*Southern Office of  
Aerospace Research and  
Development*

**06 MAR 2012**

**James Fillerup, PE, Director**  
**Southern Office of Aerospace**  
**Research and Development**

**Air Force Office of Scientific Research**

<b>Report Documentation Page</b>			Form Approved OMB No. 0704-0188	
<p>Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.</p>				
1. REPORT DATE <b>06 MAR 2012</b>	2. REPORT TYPE	3. DATES COVERED <b>00-00-2012 to 00-00-2012</b>		
<b>4. TITLE AND SUBTITLE</b> <b>SOARD Overview Southern Office of Aerospace Research and Development</b>			5a. CONTRACT NUMBER	
			5b. GRANT NUMBER	
			5c. PROGRAM ELEMENT NUMBER	
<b>6. AUTHOR(S)</b>			5d. PROJECT NUMBER	
			5e. TASK NUMBER	
			5f. WORK UNIT NUMBER	
<b>7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)</b> <b>Air Force Office of Scientific Research,Southern Office of Aerospace Research and Development,875 North Randolph Street Suite 325,Arlington,VA,22203-1768</b>			8. PERFORMING ORGANIZATION REPORT NUMBER	
<b>9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)</b>			10. SPONSOR/MONITOR'S ACRONYM(S)	
			11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
<b>12. DISTRIBUTION/AVAILABILITY STATEMENT</b> <b>Approved for public release; distribution unlimited</b>				
<b>13. SUPPLEMENTARY NOTES</b> <b>Presented at the Air Force Office of Scientific Research (AFOSR) Spring Review, Arlington, VA, 5-9 March, 2012.</b>				
<b>14. ABSTRACT</b>				
<b>15. SUBJECT TERMS</b>				
<b>16. SECURITY CLASSIFICATION OF:</b>			<b>17. LIMITATION OF ABSTRACT</b> <b>Same as Report (SAR)</b>	<b>18. NUMBER OF PAGES</b> <b>16</b>
a. REPORT <b>unclassified</b>	b. ABSTRACT <b>unclassified</b>	c. THIS PAGE <b>unclassified</b>		



# 2012 AFOSR SPRING REVIEW PORTFOLIO OVERVIEW



**NAME:** James Fillerup, Director, AFOSR/SOARD

**BRIEF DESCRIPTION OF PORTFOLIO:**

**Explore and engage Latin America research in collaboration with AFRL Program Managers in accordance with AFOSR BAA 2011-1.**

**LIST SUB-AREAS IN PORTFOLIO:**

**Manage AFOSR Basic Research Programs and Initiatives in L.A.  
Support AFRL TD Research Thrusts  
Respond to OSD and SAF/IA Bi-Lateral Forums  
Support U.S. Embassy-Santiago Mission**



# SOARD Region



## Most Proximate Countries

- **Argentina:** 22<sup>nd</sup> GDP(PPP)
  - Population: 40 M
  - Buenos Aires: 13M
- **Brazil:** 8<sup>Th</sup> GDP (PPP)
  - Population: 192 M
  - Sao Paulo: 20 M
- **Chile:** (high GDP/capita)
  - Population: 18M
  - Santiago: 5 M
- **Mexico:** ( 11<sup>th</sup> GDP (PPP))
  - Population: 113 M
  - Mexico City: 21



# A Sample of Latin America Resources & Science



Sugarcane production dependent on GPS systems for planting and harvest, local region space weather impacts industry creating a niche science area relevant to AF needs\*



Industry making science investments: Example \$0.4B USD infrastructure investment by Vale Technology Institute\*

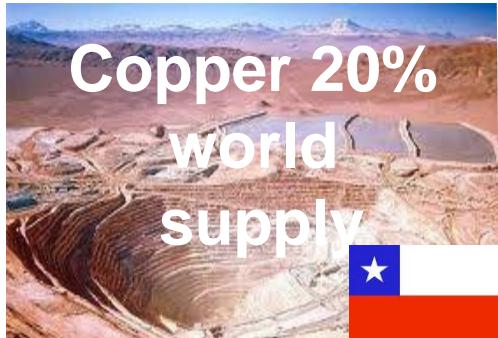


Local government and industry making investment into Brazilian science: Example \$0.7B USD PETROBRAS R&D Center, \$1.5B USD Global Tech Center Federal Univ of Rio de Janeiro\*





# A Sample of Latin America Resources & Science



CONICYT \$0.45B USD, Int. Copper Assoc \$0.1B USD, COLDELCO – Billions in infrastructure investment, ex. \$6M USD bioleaching, ... copper fiber to kill bacteria, robotics, aquaculture\*



High, dry, quite, clear location makes Chile key astronomy center in the world, for example Atacama, Atacama Large Millimeter/Sub-Millimeter Array (ALMA) \$1B USD\*



World-class science is found across S. America, example: Jicamarca Radio Observatory is the premier location for equatorial ionosphere study\*





# South American Capabilities (DoD perspective)



- Presentation: “**South American Partner Nations’ Technology Capabilities**” by ASD(RE),  
*May 2011*

Hon. Zachary Lemnios

- **Brazil:**
  - Energy (Nuclear / Biofuels), Life Sciences, Aerospace, Weapons, Materials, Nanosciences, Information Technologies, Maritime Situational Awareness
- **Colombia:**
  - Materials (Armor), Shipbuilding (Riverine crafts), IEDs
- **Chile:**
  - M&S, Information Technology, Shipbuilding (OPVs / Oceanographic vessels)
- **Argentina:**
  - Aerospace (Micro-Satellites), Cyber, Unmanned Systems

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## AERODYNAMICS

- Aerothermodynamics , J.Schmissieur
- Flow Interactions and Control, Dr. Douglas Smith

## COMPUTER SCIENCE

- Systems/software/complex network, R.Bonneau

## ENERGY

- Space Power and Propulsion, M. Birkan

## MATERIALS SCIENCE

- Configurable Multifunctional Structures, L.Lee
- Organic Materials Chemistry, C.Lee
- Materials for Extreme Environments,A.Sayir
- Structural Mechanics and Prognosis, D Stargel

## MATHEMATICS

- Computational Mathematics, F.Fahroo
- Optimization & Discrete Mathematics, D.Hearn

## NATURAL MATERIALS/BIOMIMETRICS

- Natural Materials and systems, H.Delong

## SPACE SCIENCES

- Space Science, C.Fesen
- Remote Sensing &Imaging / SSA, K.Miller

## PHYSICS

- Quantum Electronics, H.Weinstock
- Plasma and Energetic Physics, J.Luginsland, T.Hussey
- Electromagnetics, A.Nachman
- Atomic and Molecular Physics , T.Curcic



# AFRL/AFOSR Research Partners

(31 Institutions/ 42 Research Grants- 2011)



## Mexico

- Ensenada: CICESE
- Chihuahua: CIMAV
- Saltillo: CITA
- Monterrey: CMAV
- Queretaro: CINVESTAV

## Colombia

- Cali: CITA

## Peru

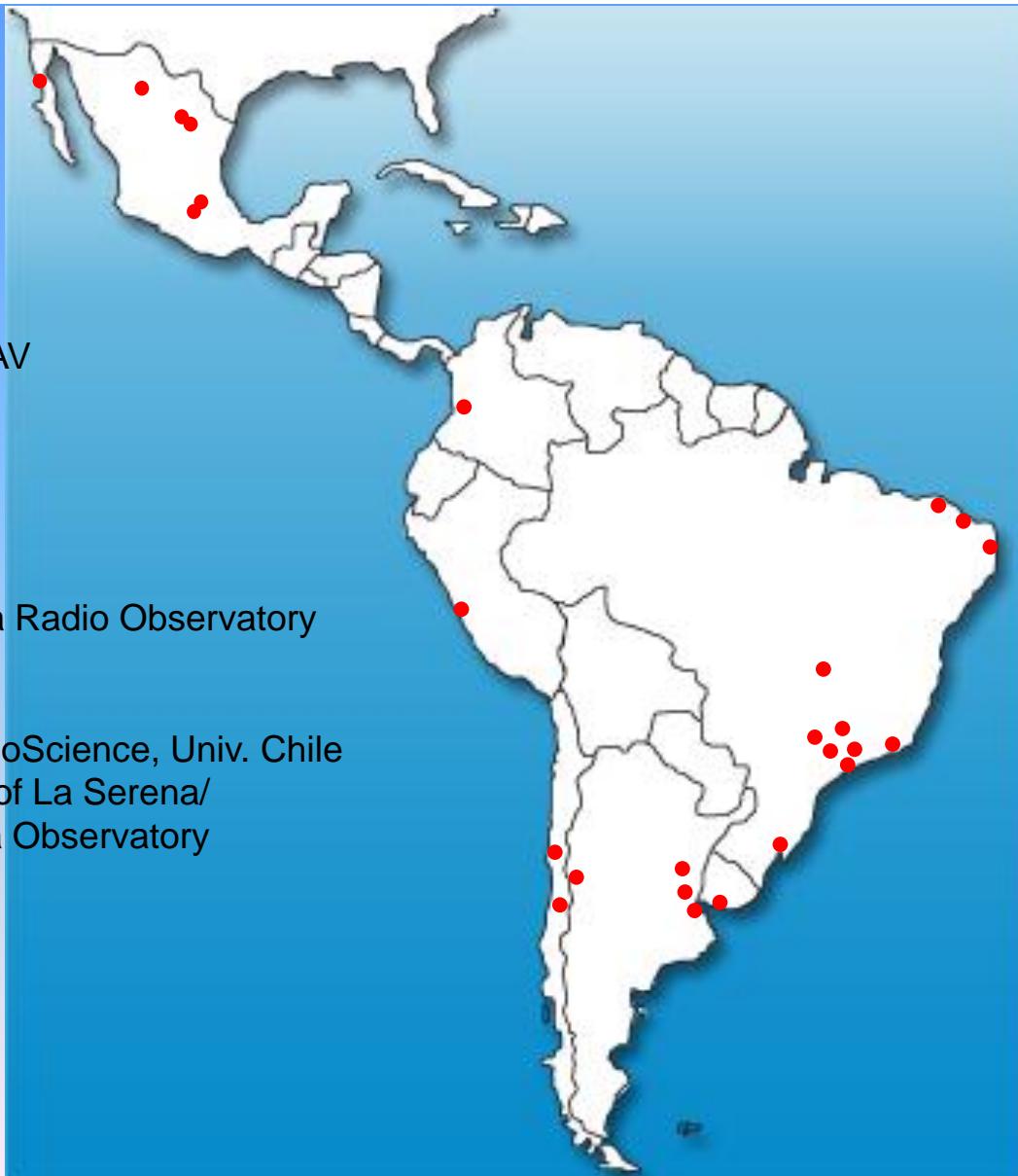
- Lima: Alcon/Jiramarca Radio Observatory

## Chile

- Santiago: USACH, BioScience, Univ. Chile
- La Serena: University of La Serena/  
Mamalluca Observatory

## Uruguay

- Montevideo: ORT



## Brazil

- Belo Horizonte: UFMG
- Brasilia: EMBRAPA
- Fortaleza: UFC-Pici
- Joao Pessoa: UFPB
- Recife: UFPE
- Rio de Janeiro: UFRJ,  
PUC-Rio, CEPEL
- Itajuba: UNIFEI
- Campinas: UNICAMP,  
CTA EVa
- Sao Carlos: USP-SC
- Sao Jose dos Campos:  
INPE, CTA IEAv
- Sao Paulo: MacKenzie
- Porto Alegre: UFRGS

## Argentina

- Buenos Aires:  
UNSAM, KHU
- Santa Fe: IMAL
- Rosario: Austral
- San Juan: CASLEO



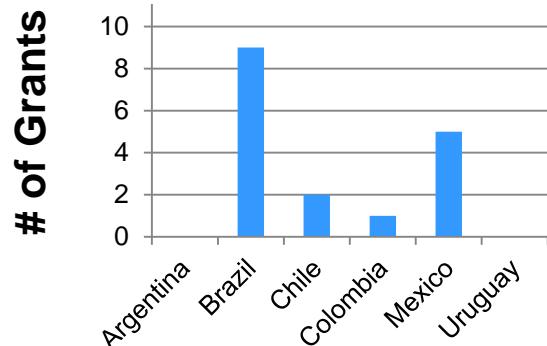
# SOARD

## FY11 Activity Summary

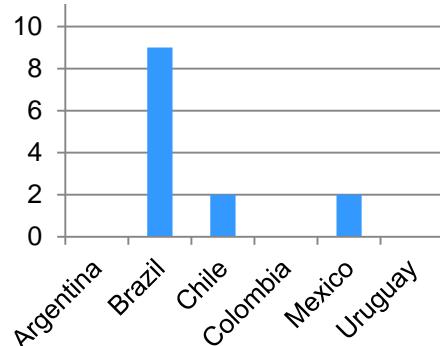


COUNTRY	WOS	CSP	R & D new starts/total
Argentina	0	1	0 / 4
Brazil	3	2	9 / 23
Chile	3	1	2 / 4
Colombia	0	0	0 / 1
Mexico	1	2	2 / 9
Uruguay	1	0	0 / 1
<b>TOTAL</b>	<b>8</b>	<b>6</b>	<b>13 / 42</b>

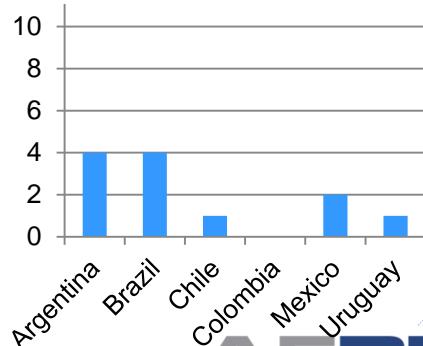
Aerospace, Chemical  
and Material Science



Physics and  
Electronics



Mathematics, Information,  
and Life Sciences



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# Brazil / Argentina Space Science



## Research Partners:

MacKenzie Univ, SP, Brazil

CASLEO Observatory, San Juan, Arg.

*All equipment owned by Brazil and operated by CASLEO, Argentina.*

**Funding:** FAPESP, CNPq, CONICET,  
AFOSR

**Project:** The Search For New Approach To  
Detect Solar CME Precursors At Sub-THz  
And Mid-IR Frequencies

## Recent Activity:

- Installation of 45GHz and 90 GHz radio telescopes at CASLEO, Argentina (Nov 2011)



**Solar Observatory**



**45 and 90 GHz Radiometer**



# Brazil / Peru Ionosphere



## Research Partners:

Nat'l Institute for Space Research  
(INPE), Brazil

Catholic Univ of Rio de Janeiro (PUC-Rio), Brazil.

Jicamarca Radio Observatory, Peru

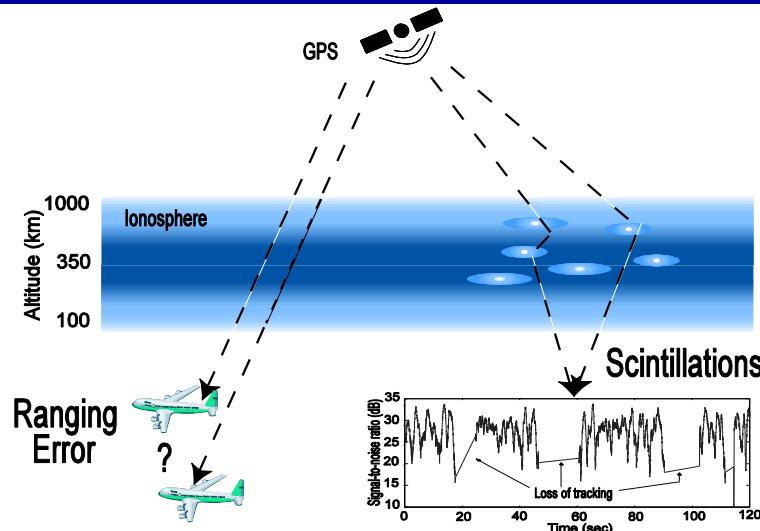
## Project: Ionospheric Irregularities

Predictions and Plumes

Characterization for Satellite Data  
Validation and Calibration

**Recent Activity:** Provide data for space-based scintillation models (AFRL SCINDA, PUC-Rio algorithm)

Christmas Island, São Luís, and Jicamarca Stations primary source of AFRL data.



**TBB and GPS antennas at São Luis - AFRL/INPE campaign, 2008**





# Brazil Hypersonics



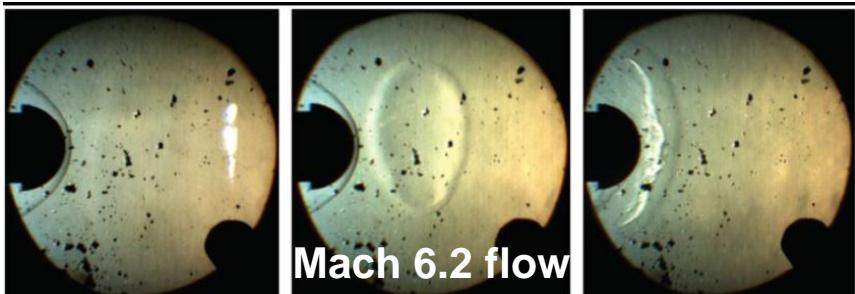
**Research Partner:** Institute for Advanced Science Studies,  
General-Command for Aerospace Technology (IEAv CTA),  
Sao Jose dos Campos

## Project:

Laser-Induced Air Breakdown  
in Low-Density for Hypersonic  
Flow Control

## Accomplishments

- Demonstrated directed energy air spike (DEAS) concept in Mach 6.2 and Mach 7.8 flows





# Chile

# Space Situational Awareness



## USAFA Falcon Telescope Network (FTN) For SSA

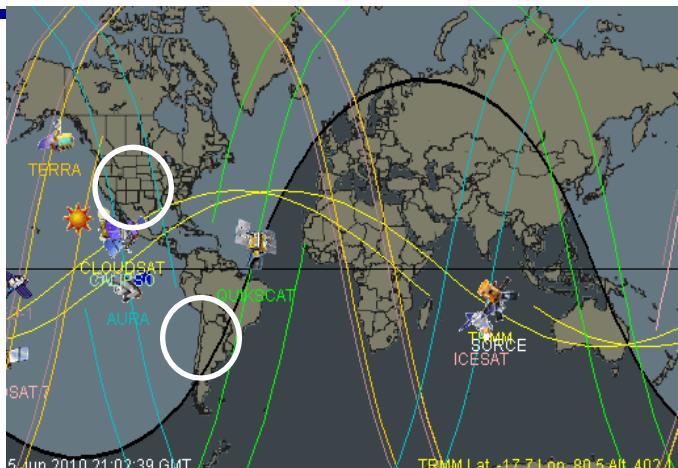
- Remote telescope network with one located in Chile to provide access to southern hemisphere



51 cm dia.  
Telescope for  
Placement in Chile

### Collaborators

- AFRL/AFOSR
- USAF Academy
- Mamalluca Observatory
- Universidad de La Serena



Mamalluca Observatory  
near Vicuña, Chile



# Mexico

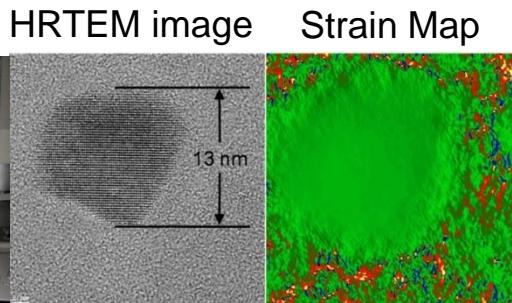
# Photorefractive Materials



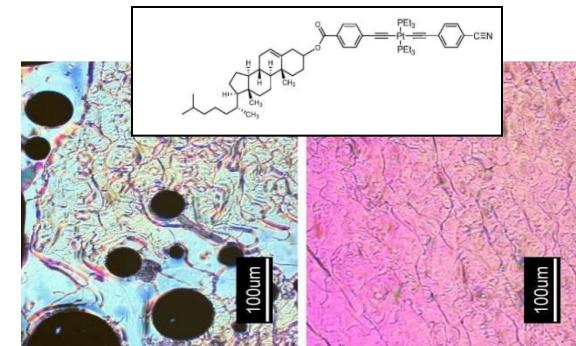
**Research Partner:** Research Center for Applied Chemistry (CIQA), Saltillo, Mexico

**Strong relationship has developed with AFOSR and RX since US/Mexican Workshop in 2008**

- **Project:** Synthesis of Chromophores for Nonlinear Optics
- **Project:** Rotaxane Molecular Switches
- **Project:** Liquid Crystals of Dendron-like Pt Complexes –Nanofilms



**Ferro-electricity discovered in nanoparticle as small as 9 nm.**



**Synthesized compound showing liquid crystallinity.**



# US/Mexico Basic Research Initiative

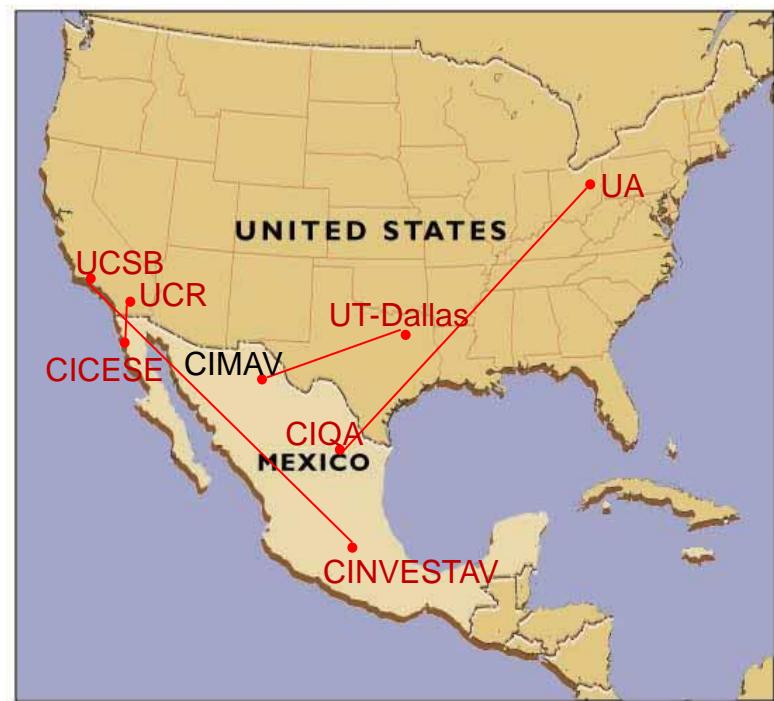


## Highlights

- Mid-term review: February 8-9, 2012 at Tech^Edge in Dayton, OH

### US/Mexican Basic Research Initiative Projects

- “Modeling, Development and Characterization of Alternate Electrodes for Flexible Electronics Applications”
  - Centro de Investigación en Materiales Avanzados (**CIMAV**)
  - University of Texas- Dallas, (**UT-Dallas**)
- “Multiphase Multifunctional Ceramic Coatings”
  - Centro de investigación y de Estudios Avanzados del Instituto Politecnico Nacional Unidad Queretaro (**CINVESTAV- Qro**)
  - University of California Santa Barbara (**UCSB**)
- “Hybrid Solid-State Photovoltaic Materials and Devices”
  - Centro de Investigación de Química Aplicada (**CIQA**)
  - University of Akron (**UA**)
- “Laser-induced patterning of transparent ceramics and metallic thin films for photonic and sensing applications”
  - Centro de Investigacion Cientifica y de Educacion Superior de Ensenada (**CICESE**)
  - University of California at Riverside (**UCR**)



-AFOSR funding US Universities  
-CONACyT funding Mexican Academic Institutions



# Future



- Continue to advance S&T discovery in collaboration with AFRL PMs and Latin American partners.
- Primary focus on Argentina, Brazil, Chile, and Mexico.
- Forge stronger bonds particularly with Brazil as it continues to surge forward in S&T (considering a Brazilian Initiative)
- Seek opportunities to co-fund research to leverage research dollars



**23 AF Participating PMs Supporting SOARD**